

**Claims**

1. In a hard decision demodulation method of QAM (Quadrature Amplitude Modulation) mode, characterized in that it includes determining in bit unit, a corresponding symbol value from a quadrature phase component value ( $\beta$ ) and an in-phase component value ( $\alpha$ ) of a received signal.

2. The method as claimed in claim 1 characterized in that, the decision method of the first bit of the first type selects one of the received values, i.e. either  $\alpha$  or  $\beta$  according to the configuration of constellation point, and determines that output is a or else b, if the value is greater than or equal to 0, wherein  $\alpha$  is a receive value of I(a real number portion) channel,  $\beta$  is a receive value of Q(an imaginary number portion) channel, and a and b is any number discriminated from each other.

3. The method as claimed in claim 1 characterized in that, the decision method of the second bit selects one of the received values, i.e. either  $\alpha$  or  $\beta$ , and determines that output is a or else b, if  $|\Omega|/2^{n-1}$  value is less than or equal to 0, wherein a and b is any number discriminated from each other, n is the size of QAM, i.e. a variable determining  $2^n$  and  $\Omega$  is the received value selected.

4. The method as claimed in claim 1 characterized in that, the decision method of bit over the third bit of the first and less than  $n^{\text{th}}$  bit selects one of the received values, i.e. either  $\alpha$  or  $\beta$ , and is determined by equation 4 below,

[Equation 4]

If it is  $4m-3 < |\Omega|2^{n-k+1} \leq 4m-1$  ( $m=1, \dots, 2^{k-3}$ ), then the output of bit number

$k$  ( $k$  is an integer greater than 3) is 'a' or else 'b', wherein  $a$  and  $b$  is any number discriminated from each other,  $n$  is the size of QAM, i.e. a variable determining  $2^{2n}$  and  $\Omega$  is the received value selected.

5            5. The method as claimed in claim 1 characterized in that, the determination of bit from  $n+1^{\text{th}}$  to  $2n^{\text{th}}$  is the same with the method of determining bit from the first to  $n^{\text{th}}$  corresponding thereto, but is determined by substituting non-selected one of the received values, i.e. either  $\alpha$  or  $\beta$  for an input value of the equation.

10           6. The method as claimed in claim 1 characterized in that the decision method of the first bit of the second type selects one of the received values, i.e. either  $\alpha$  or  $\beta$  according to the configuration of the constellation point, and determines that output is  $a$  or else  $b$ , if the value is less than 0, wherein  $\alpha$  is a receive value of I(a real number portion) channel,  $\beta$  is a receive value of Q(an imaginary number portion) channel, and  $a$  and  $b$  is any number  
15 discriminated from each other.

             7. The method as claimed in claim 1 characterized in that, the decision method of the second bit uses the received value non-selected in the decision method of the first bit of the second type and determines that output is  $a$  or else  $b$ , if the value is less than 0, wherein  $a$  and  
20  $b$  is any number discriminated from each other.

             8. The method as claimed in claim 1 characterized in that, the decision method of the third bit of the second type selects one of the received values, i.e. either  $\alpha$  or  $\beta$  according to the configuration of the constellation point and then, determines that output is  $a$  or else  $b$ , if  
25 the result of  $\alpha \times \beta$  is greater than 0 but  $|\Omega|/2^{n-1}$  is greater than or equal to 1 or the result of

$\alpha \times \beta$  is less than 0 but  $|\phi|/2^{n-1}$  is greater than or equal to 1, wherein  $\alpha$  and  $\beta$  is any number discriminated from each other,  $n$  is the size of QAM, i.e. a variable determining  $2^n$ ,  $\alpha$  is a receive value of I(a real number portion) channel,  $\beta$  is a receive value of Q(an imaginary number portion) channel,  $\Omega$  is the received value selected and  $\psi$  is the received value non-selected.

9. The method as claimed in claim 1 characterized in that, the decision method of the fourth bit of the second type is determined by an equation for switching (determining that output is  $\alpha$  or else  $\beta$ , if the result of  $\alpha \times \beta$  is greater than 0 but  $|\phi|/2^{n-1}$  is greater than or equal to 1 or the result of  $\alpha \times \beta$  is less than 0 but  $|\Omega|/2^{n-1}$  is greater than or equal to 1) the position of two received values in the decision method of third bit, wherein  $\alpha$  and  $\beta$  is any number discriminated from each other,  $n$  is the size of QAM, i.e. a variable determining  $2^n$ ,  $\alpha$  is a receive value of I(a real number portion) channel,  $\beta$  is a receive value of Q(an imaginary number portion) channel,  $\Omega$  is the received value selected and  $\psi$  is the received value non-selected.

10. The method as claimed in claim 1, the decision method of odd number bit over the fifth selects one of the received values, i.e. either  $\alpha$  or  $\beta$  according to the configuration of the constellation point and is determined by equation 7 below,

[Equation 7]

The discrimination equation of bit every odd number, i.e.  $2q-1^{\text{th}}$  bit ( $q$  is an integer greater than 3) over the fifth bit is as follows:

If it is  $\alpha * \beta \geq 0$  and  $4m-3 < |\Omega|/2^{n-q+1} \leq 4m-1$  ( $m=1, \dots, 2^{q-3}$ ), or  $\alpha * \beta < 0$  and  $4m-3 < |\psi|/2^{n-q+1} \leq 4m-1$  ( $m=1, \dots, 2^{q-3}$ ), output is 'a' or else '0', wherein  $\alpha$  is an input value of I channel,  $\beta$  is an input value of Q channel,  $n$  is the size of QAM, i.e. a variable

determining  $2^{2n}$ ,  $\Omega$  is the received value selected and  $\psi$  is the received value non-selected.

11. The method as claimed in claim1 characterized in that, the decision method of even number bit over the fifth bit selects one of the received values, either  $\alpha$  or  $\beta$  according to the configuration of the constellation point and is determined by equation 8 below,

[Equation 8]

The discrimination equation of bit every even number, i.e.  $2q^{\text{th}}$  bit ( $q$  is an integer greater than 3) over the fifth bit is as follows:

If it is  $\alpha * \beta \geq 0$  and  $4m-3 < |\psi|/2^{n-q+1} \leq 4m-1$  ( $m=1, \dots, 2^{q-3}$ ), or  $\alpha * \beta < 0$  and  $4m-3 < |\Omega|/2^{n-q+1} \leq 4m-1$  ( $m=1, \dots, 2^{q-3}$ ), output is 'a' or else '0', wherein  $\alpha$  is an input value of I channel,  $\beta$  is an input value of Q channel,  $n$  is the size of QAM, i.e. a variable determining  $2^{2n}$ ,  $\Omega$  is the received value selected and  $\psi$  is the received value non-selected.

12. In a hard decision demodulation apparatus of QAM (Quadrature Amplitude Modulation) mode, characterized in that it includes a hard decision determining portion of determining in bit unit, a corresponding symbol value from a quadrature phase component value and an in-phase component value of a received signal.